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(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
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1. Your reference

2003P07081 GB01 / P68 / JJP / RRI

2. Patent application number
(The Patent Office will fill in this part)

18 NOV 2003

0326802.6

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Siemens Aktiengesellschaft
Wittelsbacherplatz 2
München 80333
Germany

Patents ADP number *(if you know it)*

72062301 0

If the applicant is a corporate body, give the country/state of its incorporation

GERMANY

4. Title of the invention

Method of operating a wireless service

5. Name of your agent *(if you have one)*

Jan Payne

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Siemens plc
Intellectual Property Department
The Lodge, Roke Manor
Romsey, Hampshire SO51 0ZN

40958730 01

Patents ADP number *(if you know it)*

6. Priority: Complete this section if you are declaring priority from one or more earlier patent applications, filed in the last 12 months.

Country	Priority application number *(If you know it)*	Date of filing *(day / month / year)*
GB	0311277.8	16.05.2003

7. Divisionals, etc: Complete this section only if this application is a divisional application or resulted from an entitlement dispute *(see note f)*.

8. Is a Patents Form 7/77 (Statement of inventorship and of right to grant of a patent) required in support of this request?
Answer YES if:

Yes

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
Otherwise, answer NO (see note d).

. Accompanying documents: A patent application must include a description of the invention. Not counting duplicates, please enter the number of pages of each item accompanying this form.

Continuation sheets of this form	
Description	6
Claim(s)	2
Abstract	1
Drawing(s)	2 x2 SV

0. If you are also filing any of the following, state how many against each item.

Priority documents	
Translation of priority documents	
Statement of inventorship and right to grant a patent *(Patents Form 7/77)*	1
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application

Signature: JPayne — Date: 17.11.2003

Jan Payne
Chartered Patent Agent

12. Name and daytime telephone number of Person to contact in the United Kingdom: Jan Payne + 44 1794 83 3866

IDNR: 7100 / V: 03-1.01 / B: Val

METHOD OF OPERATING A WIRELESS SERVICE

This invention relates to operation of a wireless service, in particular a service which can be broadcast to its users. The particular examples described below relate to second generation (2G) mobile phone systems, but the principle of this invention is equally applicable to any system in which data can be broadcast to users over a wireless network, whether using 2G, 3rd generation (3G) or any other existing or future network system.

For some existing mobile services, it may be beneficial to count the number of users interested in receiving a pending multimedia broadcast/multicast service (MBMS), and also to count clustering of these users around the base transceiver station (BTS). In MBMS it has been proposed that counting of users interested in a service is done, in order to determine the most efficient way to deliver the data to the users. The delivery may be either by a point to multipoint (ptm) bearer, or on a normal point to point (ptp) bearer as used in general packet radio service (GPRS) today.

This simplistic approach does not provide an efficient way to measure the distance of a mobile station (MS) from the BTS, and hence gives no indication of the power level required to provide an acceptable delivery or the acceptable level of protective data encoding. There are methods by which individual mobile stations communicating with a base station can modify the power level of the base station transmission, so that the minimum necessary power is used. These involve the base station reducing its transmission power in successive iterations until the mobile station no longer receives an acceptable signal, then increasing the power just enough to communicate again. This method would be entirely inappropriate for a potential broadcast scenario, as all the resources would be taken up in determining the power level and none in actually communicating.

In accordance with the present invention, a method of operating a mobile wireless service comprises causing a network controller to broadcast to all mobile stations in a cell an offer of service; requesting from each mobile station an indication of interest in the offered service; receiving from each interested mobile station data enabling the position or received signal quality of each mobile station within the cell to be determined; analysing the arrangement of interested mobile stations in one or more predefined areas; and requiring each interested mobile station which is out of range of a

subsequent broadcast transmission to use an alternative mechanism to receive the service.

Preferably, the range of the subsequent broadcast is determined by one of received power level or received quality at the mobile station of a notification message sent from a base transceiver station to the mobile station.

Preferably, the method further comprises broadcasting at reduced power to the mobiles within range.

Alternatively, the method further comprises broadcasting at an increased or decreased coding rate to the mobiles within range.

Although a typical broadcast service, such as MBMS, does not guarantee delivery, in order to maximise the number of users which receive the service successfully, preferably, the method further comprises repeating the broadcast a number of times.

There are a number of methods by which the network controller can obtain the required data, for example the network controller may broadcast an offer of service using an MBMS channel and the mobile stations may respond using an existing random access channel (RACH), but preferably the network controller broadcasts an offer of service using an MBMS channel and the mobile stations respond using a new MBMS RACH.

The RACH is always present in a cell, but has very little free capacity; PRACH is not always deployed, but it has sufficient capacity and is already part of the standard; an MBMS specific RACH (MRACH) has the advantage that it has no legacy coding because it is new, but it would only be useful if included in the standard.

Preferably, both position and received signal quality data are received from each interested mobile station.

The mobile stations may use real-time measures of the position and power level data to decide whether they should request a ptp channel or a broadcast, but this could have the effect of changing the number from those calculated when making the determination and possibly increase the cost, so preferably, the network controller broadcasts the determined levels and each interested mobile station tests these against stored levels to calculate whether it requires a ptp channel.

A method of operating a mobile wireless service in accordance with the present invention will now be described with reference to the accompanying drawings in which:

Figure 1 shows an example cell layout having three zones around a transceiver for which the method of the present invention can be applied;

Figure 2 illustrates an MRACH logical channel for the mobile station to use in its response in the method of the present invention; and,

Figure 3 outlines an example of the method of the present invention.

The method of the present invention addresses the need to use resources efficiently in communication of the same data, a broadcast, with a number of mobile stations within a cell, without causing undue interference with neighbouring cells or reduction of quality because of interference from neighbouring cells. Current practice is simply to broadcast at full power if the number of interested MS's in a cell are deemed sufficient to use broadcast mode at all.

Figure 1 shows an example situation in which users are randomly distributed around the BTS (marked by X). The area within the cell which is within range of X is subdivided into three zones, A, B and C. The Base Station Subsystem (BSS) has a particular MBMS service available, but needs to determine the most efficient way of providing that to each MS. Thus, the network controller broadcasts a request that all of the MS within the cell must send back certain data to register their interest. If the majority of interested users are in zone A then less power or a less robust coding scheme would be needed for a ptm bearer (i.e. a broadcast) than if the majority of the users were in either area B or C which are further from the BTS. A base station controller (BSC) may choose to provide a ptm bearer in zone A only, so then an indication needs to be sent to all MS in regions B and C that they should request a ptp bearer for the MBMS session. This is most common in circumstances where users are clustered around a BTS, for example at a concert, whereas in general urban use, users tend to be more spread out and moving, so it will not always be a clear-cut decision.

The present invention provides a mechanism for the MS in the cell interested in MBMS to respond to the MBMS notification in a quick and efficient manner and for the BTS to determine suitable mechanisms for communication with interested MS's. Particular ways in which the MS can respond include using any of the logical channels

for example, random access channel (RACH), packet random access channel (PRACH) or a proposed MRACH to respond to the MBMS notification. When the MBMS notification is sent in a cell, additional signalling instructs the MS to provide information to assist the BTS in determining the distance of the MS from the BTS within the sector/cell and so to determine the communication mechanism to be used.

The BSS sends a count indication message including a list of values which will be used in its calculation to determine the communication mechanism and sends an associated bit pattern. The bit pattern sent in the notification message from the BSS may correspond to one or both of received quality and received power levels in the MS, and allows the MS to indicate the radio quality it is receiving in the cell. The BSC can set these to be any value which is useful in calculating the location of MS, but in the example below RX_LEV and RX_QUAL are used, two well known GPRS power parameters.

Upon receiving this notification/count indication, the MS responds to the BSS, indicating that it wants to receive a given service. Fig. 2 shows an example indication where an 11 bit MRACH access burst is used. 3 bits are used for each of the RX_LEV and RX_QUAL and the remainder for the notification response. This indication of service may be explicit and provide a unique identification of the required service or implicit by having only one outstanding notification/counting request at one time. The MS should also respond indicating the values of the received power levels using the bit pattern provided in the counting to allow the BSC to use an algorithm to determine whether ptm or ptp should be used, and at what power level a ptm bearer should be sent (i.e. to reach all MS in area A above with a ptm bearer, and then provide a ptp bearer to all other MS in areas B and C). The advantage of this is that unlike a blanket broadcast, the chances of interfering with transmissions in an adjacent cell are reduced. Only in those cases where the number of MS present in the cell is sufficient for a broadcast and those MS are well spread over the full area of the cell will full power be needed. There may still be occasions when this happens and coincides with a similar situation in a neighbouring cell, so giving rise to a reduction in quality, but less often.

The BSC will receive a number of responses from many mobiles, and each will contain an indication of the service required and the received power/quality levels. This information is then used in the BSC to calculate the preferred ptm channel usage.

An alternative situation is one in which the BSC decides to broadcast at standard power with an increased coding rate. This will have the effect that an MS at the limit of the cell will get a poor quality level, but that the MS nearer to the BTS will receive their broadcast more quickly and hence the length of time for which the broadcast is transmitted will be reduced. In some cases it can still be more efficient to use a faster broadcast and repeat it several times to improve the chances of a particular MS at the edge of the zone getting worthwhile reception, than to use ptp bearers. The BSC may need to take into account the effect of broadcasting at full power on neighbouring cells.

An example sequence of events by which the BSS can determine how to transmit and MBMS service is illustrated in Fig. 3. The BSS sends a count indication message (step 1) to a plurality of mobile stations. This message contains measurement values and corresponding bitmaps for response. Each MS sends a response (step 2) containing a short service ID in the format shown in Fig. 2 of 5 bits and power indication bitmaps of 6 bits. The BSS calculates timing advance for all responses (step 3), provides timing advances and responses from all MS's to the BTS (step 4) and calculates a preferred distribution of ptm and ptp bearers (step 5). The BSS then sends a message (step 6) re provision of ptm bearers (a list of power indication bitmaps which should use the ptm bearer) and also sends a message (step 7) re indication of use of ptp bearers (a list of power indication bitmaps which should use the ptp bearer).

More generally, the stages can be split up, the first being "count indication sent" in which the message is sent from the BSS in the cell in order to determine the need or not for a ptm or number of ptp MBMS bearers. This may contain the following: an indication that a response is required; a service identity; and, a list of received powers/received quality in the MS and associated bitmaps for the response on the chosen channel – for this example, MRACH using RX_LEV and RX_QUAL, although other measures could be used. The RX_LEV (received power level) tells the BTS the received power at the MS, whereas the RX_QUAL provides an approximation of the carrier to interface ratio (C/I) received at the MS.

Next, the MS responds on a random access channel indicating the various parameters requested in the notification message. The more sophisticated the request for information, the more likely it is that the MRACH will have to be used for the response message. The RX_LEV and RX_QUAL are both 3 bits in length, and hence

the resulting combination of response could require up to 64 different responses. This can be managed in 6 bits, leaving 5 bits for the response indication on the MRACH if an 11 bit access burst is used. Fig. 2 shows a possible implementation of the 11 bit access burst where the first 5 bits are fixed and used to indicate notification response.

The BSS then calculates ptm or ptp. Any and all of the received values may be fed into an implementation specific algorithm in order to allow the operator to take into account the full operating environment before choosing to provide a ptm bearer or number of ptp bearers or combination for the delivery of MBMS.

Finally, an assignment stage where the BSS uses the codes received in the responses (indicating the RX_LEV and RX_QUAL) to indicate to each group of MS that they should use a ptp or ptm bearer. For example, all MS with an RX_LEV higher than a given value should use the ptm channel, and those with the RX_LEV below a certain value should use a ptp channel. Each MS will have measured the requested data and sent this back in its response message. When the indication of the cut-off levels is sent out, either the MS will have stored the data in its response message and use this to determine which side of the boundary it falls, or else it will measure the data again at the instant of receiving the notification and use that as its basis for which group it falls into. This latter would result in some changes to the numbers in each category, so may be viewed as less desirable if it increases the overall cost of resources. The user may have the option not to connect, if it does not fall within the range of the ptm broadcast, despite having expressed an interest in the service.

It should be noted that the specific values provided herein are an example of possible parameters that may be used in the determination of the need for a single ptm or a number of ptp bearers, or a combination of both.

CLAIMS

1. A method of operating a mobile wireless service, the method comprising causing a network controller to broadcast to all mobile stations in a cell an offer of service; requesting from each mobile station an indication of interest in the offered service; receiving from each interested mobile station data enabling the position or received signal quality of each mobile station within the cell to be determined; analysing the arrangement of interested mobile stations in one or more predefined areas; and requiring each interested mobile station which is out of range of a subsequent broadcast transmission use an alternative mechanism to receive the service.

2. A method according to claim 1, wherein the range of the subsequent broadcast is determined by one of received power level or received quality at the mobile station of a notification message sent from the base transceiver station to the mobile station.

3. A method according to claim 1 or claim 2, further comprising broadcasting at reduced power to the mobiles within range.

4. A method according to claim 1 or claim 2, further comprising broadcasting at an increased or decreased coding rate to the mobiles within range.

5. A method according to claim 4, further comprising repeating the broadcast a number of times.

6. A method according to any preceding claim, wherein the network controller broadcasts an offer of service using an MBMS channel and the mobile stations respond using a an existing random access channel (RACH).

7. A method according to any of claims 1 to 5, wherein the network controller broadcasts an offer of service using an MBMS channel and the mobile stations respond using a new MBMS RACH (MRACH).

8. A method according to any preceding claim, wherein both position and received signal quality data are received from each interested mobile station.

9. A method according to any preceding claim, wherein the network controller broadcasts the determined levels and each interested mobile station tests these against stored levels to calculate whether it requires a ptp channel.

ABSTRACT

A method of operating a mobile wireless service comprises causing a network controller to broadcast (1) to all mobile stations in a cell an offer of service. The network controller requests from each mobile station an indication of interest in the offered service and receives (2) from each interested mobile station data enabling the position or received signal quality of each mobile station within the cell to be determined. The network controller analyses the arrangement of interested mobile stations in one or more predefined areas and requires (7) each interested mobile station which is out of range of a subsequent broadcast transmission use an alternative mechanism to receive the service.

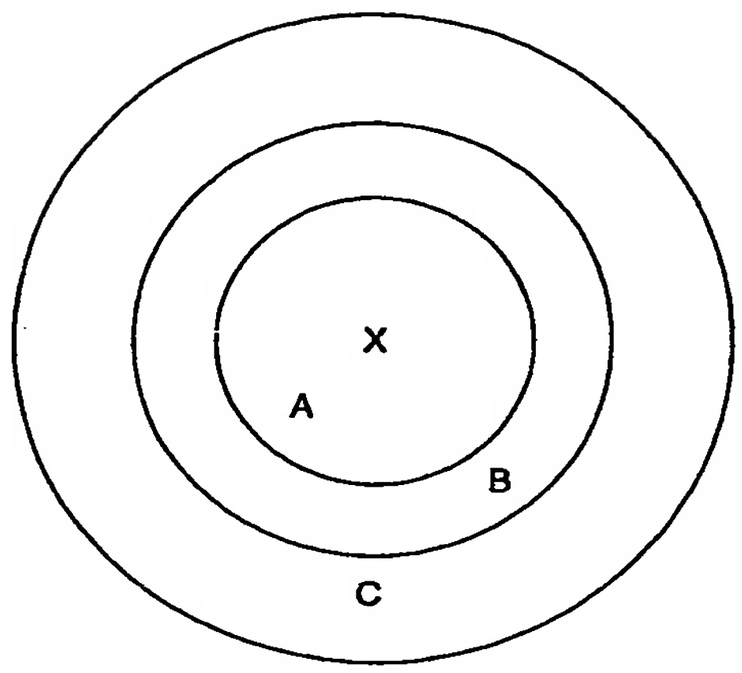

Figure 1 Cell layout with three areas for MBMS algorithm

1	2	3	4	5	6	7	8	9	10	11
Notification response					RX_LEV			RX_QUAL		

Figure 2 11 bit MRACH access burst

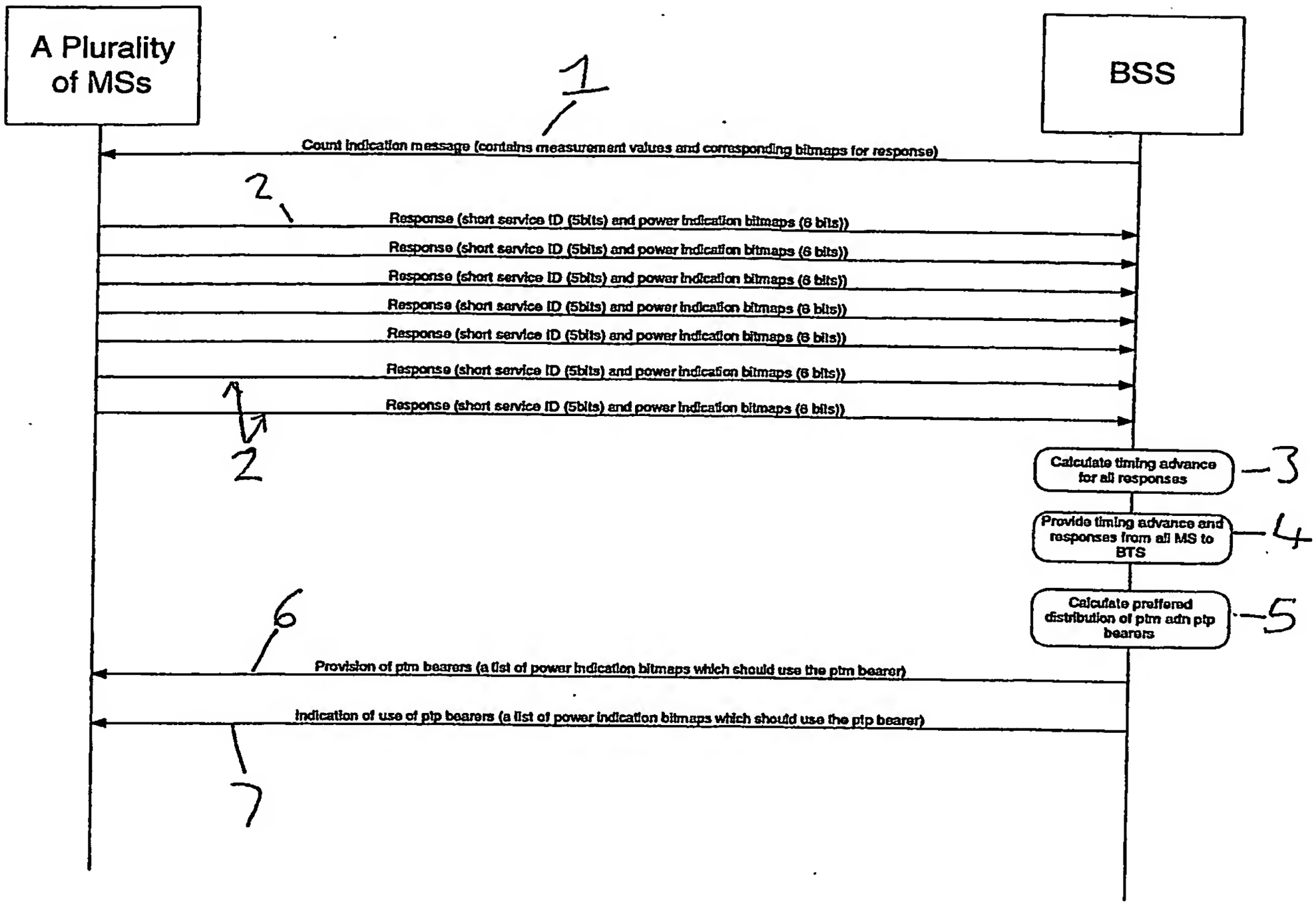
A Plurality of MSs
BSS
1
Count indication message (contains measurement values and corresponding bitmaps for response)
2
Response (short service ID (5bits) and power indication bitmaps (6 bits))
Response (short service ID (5bits) and power indication bitmaps (6 bits))
Response (short service ID (5bits) and power indication bitmaps (6 bits))
Response (short service ID (5bits) and power indication bitmaps (6 bits))
Response (short service ID (5bits) and power indication bitmaps (6 bits))
Response (short service ID (5bits) and power indication bitmaps (6 bits))
Response (short service ID (5bits) and power indication bitmaps (6 bits))
2
Calculate timing advance for all responses
3
Provide timing advance and responses from all MS to BTS
4
Calculate preffered distribution of ptm adn ptp bearers
5
6
Provision of ptm bearers (a list of power indication bitmaps which should use the ptm bearer)
Indication of use of ptp bearers (a list of power indication bitmaps which should use the ptp bearer)
7

Figure 3.